Executive Summary

Chapter 1

Chapter 1 provides background for the proposed monitoring program. In order to protect national parks for future generations, it is vital that the National Park Service (NPS) observes and understands the condition of natural resources in our parks. To address this need, NPS implemented a strategy known as "vital signs monitoring" to develop scientifically sound information on the status and long-term trends of park ecosystems and to determine how well current management practices are sustaining those ecosystems. The Southwest Alaska Network (SWAN) consists of five Alaskan park units (Aniakchak National Monument and Preserve, Alagnak National Wild River, Katmai National Park and Preserve, Kenai Fjords National Park, and Lake Clark National Park and Preserve). Collectively these units comprise 9.4 million acres or 11.6 percent of the total land area managed by the National Park Service. Network parks encompass climatic conditions, geologic features, near pristine ecosystems, natural biodiversity, freshwater, and marine resources equaled few places in North America. This network of relatively untouched wilderness parks is a unique resource and offers unparalleled opportunities to study and monitor ecological systems minimally affected by humans. In recognition of this, the SWAN monitoring framework will emphasize (i) establishing reference conditions representing the current status of park, monument, and preserve ecosystems; and (ii) detecting ecological change through time. The Network's conceptual foundation addresses the interplay of multiple forces that occur at a variety of spatial and temporal scales, and identifies climate/landform, natural disturbance, biotic interactions, and human activities as the most important drivers in determining regional ecosystem structure and function.

Chapter 2

Chapter 2 contains an overview of conceptual models used during the planning phases of vital signs monitoring. The character of SWAN parks is largely determined by the complex and dynamic physical, geological, and chemical interactions of marine, aquatic, and terrestrial subsystems. Therefore, a basic understanding of atmosphere-land-ocean interrelationships is important for us to comprehend how physical and biological drivers influence ecosystems. Climate influences on SWAN ecosystems are strongly tied to conditions in the North Pacific, especially location and strength of the winter Aleutian Low and the shift in storm track direction that occurs in summer. SWAN ecosystems are also shaped and maintained by disturbances. Infrequent large-scale disturbances (volcanic eruptions, earthquakes, tsunamis) and more frequent, small-scale disturbances (insect outbreaks, floods, and landslides) maintain a shifting mosaic of landscape patterns. Important biological interactions in SWAN include the transport of nutrients by mobile species, herbivore-predator interactions that maintain a heterogeneous distribution of resources, and the presence of "ecosystem engineers" that structure habitats and influence the distribution and abundance of other species. Ecological links between the coastal, freshwater, and terrestrial subsystems involve the flow of water, nutrients, and energy. Salmon play an extremely important role in Network ecosystems and provide a link between marine, terrestrial, and freshwater subsystems. Human activities acting as stressors in SWAN ecosystems stem from far-field influences related to global industrialization and near-field influences related to regional development and park visitation. The most important far-field influences are climate change, invasive species introductions, and effects on migratory fish and birds outside of Network parks. Near-field influences include a variety of activities, but all act in similar ways to affect fish and wildlife via disturbance, habitat loss or fragmentation, and overharvesting.

Chapter 3

Chapter 3 describes the selection of a final list of vital signs. Candidate vital signs were chosen during a series of scoping workshops held between August 2002 and April 2003. The initial list that emerged from the scoping workshops included 61 vital signs. This list was reduced to 38 after similar indicators were merged under a single vital sign, or duplicate entries or weakly supported vital signs were removed. Technical Committee members reviewed each vital sign for why it was selected, how it relates to conceptual ecosystem models, and how it contributes to the Network's goals and objectives for monitoring. Committee members numerically ranked each of the vital signs based on ecological significance and relevance to park resource management and protection issues. The Board of Directors reviewed the selection process and rankings, and approved the list of vital signs in March 2004.

Chapter 4

Chapter 4 discusses specific sampling designs relevant to long-term monitoring in SWAN parks. The SWAN I&M program's approach to developing sampling designs is to (i) identify existing monitoring programs and set up a protocol to acquire data that meet our objectives, (ii) collect data from satellite or aerial platforms on a parkwide scale when feasible, and (iii) develop ground-based designs only for those vital sign metrics for which remote sensing or aerial measurement provide data at an inadequate spatial resolution to meet SWAN monitoring objectives. We will use a combination of random and nonrandom sampling designs for those vital signs whose protocols are developed by SWAN alone. The random sampling design will primarily utilize a generalized random-tessellation stratified (GRTS) and systematic sample with a random start. When necessary, we will incorporate accessibility and prioritization components into these designs, where prioritization criteria will be heavily influenced by park staff. High-priority, easily accessible units or sites will be sampled more frequently than other ones.

Chapter 5

Chapter 5 outlines the requirements and timeline for protocol development. Protocols consist of a narrative, standard operating procedures, and supplementary materials. The protocol narrative describes why a particular vital sign and metric(s) were selected; specifies objectives and details of the proposed sampling design to meet those objectives; identifies field methods that will be used to gather data; explains how these data will be managed, analyzed, and reported; discusses personnel requirements and training procedures; and describes operational requirements such as scheduling, equipment, and budget. Standard operating procedures provide detailed instructions on how to accomplish every topic mentioned in the narrative. Protocol development summaries (PDSs) have been prepared for 31 SWAN vital signs for which monitoring will be implemented within 3–5 years. Each PDS briefly addresses key elements of sampling protocols and includes a justification and list of measurable objectives. A schedule has been established for the development and testing of protocols for vital signs monitored by SWAN, monitored in partnership with SWAN parks, or with other federal and state agencies.

Chapter 6

Chapter 6 summarizes the contents of the SWAN Data Management Plan. The goal of data management is to ensure the quality, interpretability, security, longevity, and availability of vital signs monitoring data. To achieve this goal it is crucial that monitoring staff understand and perform data stewardship responsibilities in the production, analysis, management, and end use of data as described in the Data Management Plan and the specific monitoring protocols. The SWAN uses a project tracking database to document and support the progress of information collected for vital signs monitoring.

Chapter 7

Chapter 7 discusses avenues for data analysis as part of the SWAN monitoring program. Various descriptive statistics (e.g., means and standard deviations) and graphs will be generated frequently to provide information on status of a given vital sign. The frequency of analysis will depend on the vital sign and metric. We will use empirical Bayes models to estimate trends. These models allow specification of different covariance structures, removal of the estimated sampling variance component, and incorporation of additional variables thought to influence trends in the response variable (e.g., abundance). When appropriate, we will build a candidate set of trend models that includes variables thought to most influence a given vital sign metric, use information-theoretic approaches to choose the best-fitting covariance structure and model, and, if necessary, model average over the candidate models. Bayesian belief networks (BBNs) will be used to link monitoring data to decisions regarding the current "state of the park." Information will be reported in numerous formats using language that simultaneously fits within both scientists' and nonscientists' frames of reference, such that progress and findings are technically accurate and understandable.

Chapter 8

Chapter 8 outlines the proposed administrative framework for the SWAN monitoring program. The "network concept" is based on the principle of park and Network staff working cooperatively to plan, coordinate activities, share resources, leverage additional resources, and implement operational monitoring. Programmatic integration of monitoring with park operations such as protection, interpretation, maintenance, and stewardship is crucial. A key challenge for SWAN is to secure the range of technical specialists needed to implement the monitoring program without overcommitting the Network budget to staff salaries. We plan to meet this challenge by strategic sharing of positions with the Network parks, Alaska Regional Office, and outside agency partners.

Chapter 9

Chapter 9 establishes a schedule for implementation of the monitoring program. Operational monitoring for vital signs will be phased in over 5 years beginning in 2006. Throughout the implementation phase, draft protocols will be written, field tested for 1–2 years, submitted for peer review, and finalized. Vital signs that can be monitoring by remote sensing, such as landscape processes, glacial extent, and land cover/land use, will be implemented first because they provide important context for ground-based monitoring that will follow.

Chapter 10

Chapter 10 presents the proposed budget for the first year of implementation (FY 2007). Vital signs monitoring is intended to fill gaps in what parks are already doing by augmenting existing park personnel and base funds. In SWAN, allocation of vital signs monitoring and water resources funding reflects this intent. A greater proportion of Network funding will be directed to program areas that parks currently and historically have not had financial or staff resources to sustain, i.e., terrestrial vegetation, physical resources, and marine nearshore resources. Lesser funding will be directed to program areas for which parks have ongoing monitoring and existing staff, i.e., terrestrial fauna.